

9/12/13 (30 Minutes)

To Do List:

- Prototype Ideas, bring ideas to next team meeting.
- Research existing systems to adapt for our needs via Google Scholar and Previous Design Projects
- Have Logbooks by next meeting
- Contact CNR dept. About possibly visiting on campus fishery research facilities to obtain possible testing products (fish excrement).

Meeting Highlights

- Options for visiting Clear Springs Inc. for possible sponsorship of prototypes.
- Bring design concepts to next team meeting for discussion

9/19/13 (30 Minutes)

- Levi and Matt get driving to cert to molly in ME depart.
- Prepare questions for visit to Clear Springs. Done by next meeting.
- Additional researching topic (summarize ideas in email, not just send out articles)
- Impossible to change flow- mountain flow feed
- Modeling OCF and Sediment Transport in Solid Works (study and practice)
- Eco- Hydraulics – possible design, using natural flow and use hydraulic circulation to clean manure.
- Pet store aquarium tank pump idea
- Initial shop orientation with Jeremy Tuesday at 3:30 – with in next few weeks – possible model scale building (print out resources from course web site: shop orientation, need appropriate clothing).
- Small scale pond to study for testing ideas and prototypes
- EPA regulations on waste from cleaning system (effluent discharge of fish waste)
- Boise Eco Hydraulics Research Lab for large scale test possibility, or study of flows.
- Matt and Levi: pet store visit
- Jeremy Leading Meeting
- Simulation

9/26/10 (44 minutes)

- Getting sample for pumping waste, experiment on time constants and critical velocities of the waste we are cleaning (Creating testing facility?)
- Ask Aquaculture lab for samples and see how they operate, set up meeting – Levi will arrange meeting

- Discuss Environmental concerns (EPA regs., some listed in Clear Springs Power Point provided current regs.)
- Fluid Models, open channel flow model for testing, weir study, see where particulate may settle in the flow of the ponds.
- Current Pool cleaning technology, how it works, filter system etc...
- Questions for Meeting with Clear Springs
  1. How fast can laborers clean and how much labor does it take (hours it takes for screening and pumping), what screen sizes do they use, initial design of current pumping system (how their current waste pumping system works)
  2. Construction of Quiescent Zone, what is the separation between zones
  3. Design parameters of possible inserts of into the pools, for example changing topography of pool bottom.
  4. What can go down stream, as in what can we send down to quiescent zone
  5. What have you tried and what has failed, what ideas have you tossed around.
  6. Where do you have the most accumulation of waste, does it need to be moved somewhere in order to be cleaned, how thick can the fish waste get at a given time, ie how much
  7. Are the ponds ever drained
  8. Electricity supply

10/3/2013 (30 minutes)

- Visit to aquaculture lab notes:  
Using a baffle to increase velocity and settle particles.
- Aqua Culture Visit minutes = 45 Minutes
- Baffle idea, possibility of moving baffle adaptation design with a horizontal plate installed.
- Scott is willing to provide biosolid sample for testing and be a contact for information regarding our topic.
- Team Meeting after aquaculture visit: research filter ideas and begin research on baffles.

10/10/13 (45 Minutes) Meeting with Dr. Liou on Ideas

- Dr. Liou has been researching this idea for several years now, he is willing to provide us with data as well as provide us with a flume and facilities to conduct small-scale research in the basement of BEL.
- One idea Dr. Liou has been working with is a brine injection method, since the particle density is very close to that of water, when brine is injected, a layer of it rests on the bottom of the tank, and the particles float atop the brine since they have a less dense and the brine carries the biosolids via a pump to the effluent wastage area.

- Another proposed idea was to build a incline that runs the length of the raceway, to let the biosolids settle in a concentrated area at the lowest point of the plane and then devise a method for pumping them out.
- Dissuasion topics after meeting:
  1. Talk with Dr. Coats on the idea of recycling fish biololids with his plastics program.
  2. Fertilizer use for our waste generated.
  3. If brine is used, we need a way to separate brine from biosolid, and possibly recycle brine.
- To Do List:
  1. Email Dr. Liou to get copies of testing visuals (videos) etc.. for snapshot day.
  2. Gather information on snapshot day, what we need to get done.
  3. Speak with Dr. Coats on his plastics project and if fish solids can be used.
  4. Begin CFD modeling
  5. Speak with Erin on getting testing meters from JML.
  6. Begin small scale testing.
  7. EPA effluent regulations research.

#### 10/11/13 Snapshot Day #1 (60 minutes)

- Matt, Kate, and Levi put together visual aids for presentation before group met.
- Ideas presented were baffle concept, brine concept, slope concept and automated pump concept.
- After snapshot day was complete, our group is at a good point in the project, we have 4 ideas for testing and modeling and that is our next step.

#### 10/17/13 Team Meeting (30 minutes)

- Group consensus is that snapshot day went well, we are at a good point in the project and have a solid game plan to continue on.
- Discussion of Designs for Project:
  1. Brine Design
    - a. Concentration of solution is critical, we need to know exact density, know all salt amounts at all times.
    - b. Flow rate measurements: we need to know if a faster flow could mix brine, also could fish swimming create turbulence that mixes our brine solution.
    - c. Attempt freshwater injection see if this method of just increasing velocity with freshwater injection could work as well, to make dealing with the brine not an issue.
    - d. Need to know size and geometry of design.
  2. Baffle Design

- a. Research modifications we can make to increase baffle efficiency.
  - b. Working on ideas for a new design using a mechanical device to move the baffle the way we need to to.
- Meeting Closing:
  1. Flow measuring is critical in all experiments, take good data measurements.
  2. Draw up a scope of work, have it to Dr. Xing by next meeting, with project dates and deadlines up to the end of fall semester.
  3. Levi to speak to Scott on having him be a expert contact for our design review, and a client for our design review.

#### 10/24/13 Team Meeting (30 Minutes)\_

- Scope of work drawn up before team meeting, it is located in drop box folder under Scope of Work.
- Meeting Highlights:
  1. Test Baffle Design first.
    - a. Make sure we have all we need to conduct experiments ready by end of next week.
    - b. Get flow meters from JML.
    - c. Make sure flume is 100% working before testing.
    - d. We have decided to only focus Brine and Baffle this semester.
    - e. Research ideas for filtration on brine idea.

#### 10/29/13 Flume Cleaning (2 hours)

- Overview: Matt, Jeremy and Kate met at BEL to set up and clean flume for testing.
- Dimensions:
- Materials that we will need to begin testing on Baffle idea.
  - a. Flow Meter
  - b. Mounting Device (maybe)
  - c. Camera for recording data
  - d. Dye for flow visual
  - e. Biosolids for experimentation

#### 10/31/13 Team Meeting (60 minutes)

- Baffle Construction:
  1. Before group meeting with Dr. Xing, all group members met in the design suite to construct basic baffles for testing.
  2. To accomplish this we used a piece of scrap plastic, the baffle dimensions were 6 inches long, 14 inches tall, and roughly  $\frac{1}{4}$  inch thick. We kept a sheet of scrap plastic to keep incase we need to build more baffle designs or modifications.

- Team Meeting:
  1. Highlights:
    - a. We discussed that we will test a basic baffle concept for experiment 1.
    - b. Make sure we stabilize flow before we begin testing.
    - c. Possibility of creating a super critical flow behind baffle.
    - d. Modified Ideas, see logbook sketches.
    - e. Will use this data to see if baffles can be an implemented solution, will progress on modified baffles after testing possibly.
    - f. Possibility of moving baffle idea in the future.

### 11/5/13 Baffle Testing Day 1

- Overview
  1. Kate, Levi and Matt conducted baffle testing.
  2. We began by setting up flume and filling it with water.
  3. Material bought for testing:
    - a. D batteries
    - b. Dye for flow visuals
    - c. Bread crumbs and fish food to represent solids.
    - d. Biosolids from aquaculture lab (provided free from Scott)
- Test 1: Basic Baffle
  1. We could not calibrate flow meter, possibly because the flume is too small for this flume, also we think flow meter is interrupting flow too much. We will proceed without it.
  2. Baffle was 1 inch from the flume bottom, we were able to wedge it square in the channel, baffle was also placed roughly 1/3 length of flume.
  3. Test results were recorded via Matt's iPhone, see video for details.
  4. Test proved our concept to work well, all solids were moved quickly off the bottom floor and settled in what could be our mock QZ.
  5. One issue with this design was that the solids began recalcitrating in a hydraulic region behind the baffle, we could fix this possibly with a modified moving or baffles in series design, or a horizontal plate installed.
- Test 2: Basic Baffle
  1. For this test we kept the baffle 1 inch off the bottom of the tank and moved it 24 inches down the flume.
  2. We had similar results as test 1, only solids were settled out more towards the end of flume, as to be expected.
  3. For visual of tests see videos.
- Conclusion:
  1. The conceptual experiments for the baffle design went well, all went to plan and we now have several solid ideas on how to proceed.
  2. We need to talk with Scott and Dr. Liou about a large scale test in the future.

### 11/7/13 Team Meeting (1 ½ Hours)

- Group Meeting before regular meeting with Dr. Xing
  1. All group members were present in “pre-meeting” to discuss testing day 1 and how we plan to proceed.
  2. We discussed the idea of expanding our baffle idea to a modified design, with horizontal plates or possibly a set of baffles in series.
  3. From here we will look at various baffle ideas on CFD with Jeremy.
  4. We have decided to scrap the brine idea, we felt that we do not want to take Dr. Liou’s concepts and want to develop our own, we also feel brine presents too many challenges at the full scale.
  5. Next testing day we will test a pump idea discussed in meeting, see individual logbooks for pump drawings.
- Team Meeting with Dr. Xing
  1. Data from baffle testing was presented to Dr. Xing, he seems pleased with progress.
  2. Clear Springs visit scheduled for 11/23/13, Matt, Kate and Jeremy plan on driving themselves, Levi will accompany Dr. Xing and Dr. Liou, Levi will arrange to rent a van, Dr. Xing has agreed to make travel arrangements and hotel plans.
  3. Team needs to have a presentation ready for Clear Springs Executive team during visit. Have all questions ready for them.
- Discussion after meeting with Dr. Liou about measuring Flume Flow.
  1. He suggests that we use a weir to calculate flow or make a pitot tube.
  2. We will try to measure flow off of the weir.

### 11/12/13 Testing Day 2: Automated Pump (3 Hours)

- All group Members were present, we began by going to the shop in the design suite to construct pump ideas.
- Since we cannot design a quick automated mechanism, for this conceptual quick prototyping we will pull pump along flume by hand.
- We began by collecting scrap supplies, we acquired wiring for making a pulling device, a long tube of PVC pipe and cut it into two 5 ½ inch sections, and some basic plastic tubing (insert diameters here) from Dr. Brooks and his lab in JML, also a roll of duct tape was acquired.
- Two prototypes were built.
  1. First was a tube with a 1/8 inch slit along the tube.
  2. Second was a tube with a series of 1/8 inch holes drilled along the tube.
  3. We secured the ends of the PVC with duct tape, this was unsuccessful, we decided to finish up on Thursday.
- We also noticed that our flume had acquired more dust and grime, we spent some time cleaning and pumping dirty water out.

### 11/14/2013 Team Meeting (2 hours)

- Prior to meeting with Dr. Xing we met in the design suite to glue plastic ends to our pump prototypes, we used silicon and made a water tight seal and discussed how we plan on proceeding from there.
- We also began drafting a presentation for our trip to Clear Springs.
  1. A copy of the team Presentation for Clear Springs is included in the Team Drop Box.
  2. The contents of the Presentation:
    - a. Design Parameters.
    - b. Project Goals and Deliverables.
    - c. Design Concepts: Pump and Baffle
    - d. Lists of Questions for Clear Springs Employees.
- Meeting with Dr. Xing
  1. We presented our two prototypes that we plan on testing on our next Tuesday experimentation day.
    - a. Dr. Xing approves of our ideas and has instructed us to experiment with them and present visual data on their conceptual design.
    - b. Dr. Xing has also instructed us to begin CFD modeling with Jeremy on baffle designs to have at least by the next snapshot day.
  2. Team Presentation for Clear Springs was reviewed by Dr. Xing.
    - a. He suggests we include brine solution, but that needs to be cleared by Dr. Liou since it is his intellectual property, Dr. Xing will do this.
    - b. He suggests we include videos of our testing and that we email the slideshow to him by next team meeting.
  3. Meeting with Clear Springs discussion topics.
    - a. A sponsorship and confidentiality contract is the goal of this meeting, so have a clear and professional presentation ready.
  4. To Do List by next meeting:
    - a. Begin modeling baffle in CFD
    - b. Finish CS presentation
    - c. Make sure we have all things personal ready for travel to CS.

### 11/19/13 Pump Small Scale Prototype (2 Hours)

1. Team met in BEL lab to test pump small-scale conceptual prototypes.
2. Team tested pump in slit cut about 1/8 in wide, along the entire width of PVC pipe, see video for results.
3. Team tested pump with 1/8 th inch perforated holes along width of PVC pipe, see video for results
4. Team was successful I removing bio solids with each prototype.

### 11/21/2013 Team Meeting (1 Hour)

1. Team met prior to meeting with Dr. Xing to write a presentation for meeting with Clear Springs on Saturday, November 23<sup>rd</sup>.
  - a. Copy of presentation can be seen in Drop Box Folder.
2. Presentation includes following contents:
  - a. Intro
  - b. Design parameters
  - c. Goals and Deliverables.
  - d. Current Design
  - e. Questions: Can be seen on presentation in Drop Box.
3. Team met briefly with Dr. Xing to present Power Point and discuss final travel plans to Clear Springs for Saturday.

#### 11/23/2013 Team Meeting in Buhl, Idaho with Clear Springs Employees and Executives

1. Meeting Highlights:
  - a. Discussed specific design technology and raceway specifications, detailed notes can be seen in personal logbooks.
  - b. Discussed effluent regulations for pump designs, can be seen individual logbooks
  - c. Presented power point to employees and executives discussed possible baffle modifications and logistics of design at their facilities.
  - d. Design needs to be portable, inexpensive and able to adapt to all their farms.
2. Design Highlights:
  - a. Cannot drop flow in raceway more than 1 CFS for an extended time
  - b. Must be lightweight to move from raceway to raceway
  - c. Cost effective
  - d. Must be compatible with day-to-day operations such as screening and grading.
3. Team was granted funding for project pending a Scope of Work and designs.
4. This meeting served as our Design Review.

#### 12/5/2013 Team Meeting (30 Minutes)

1. Team discussed outcome of meeting with Clear Springs
2. Team will have Scope of Work completed before break to send to Clear Springs to approve funding over winter break
3. Discussed Snapshot Day 2, team will use Clear Spring presentation for Visual aids, as well as videos from small-scale prototyping.

#### 12/6/2013 Snap Shot Day 2 (2 Hours)

1. Team used Clear Springs presentation as visual aids as well as videos from experimental testing; both can be seen in Drop Box folder.
2. Scott met briefly with us and discussed baffle designs, he has tried various models and modifications himself, moving baffle with flow is difficult according to him, pulleys and springs may help with this.

12/10/2013 Team Meeting to discuss budget and scope of work (2 Hours)

1. Team scope of work and budget can be seen in Drop Box under Scope of Work

12/12/13 Team Meeting with Dr. Xing (1 hour)

1. Team discussed Scope of Work with Dr. Xing
2. Team will made suggestions on scope Friday
3. Team will attempt to build a full scale prototype for Expo, pending results from testing and experimentation
4. Team discussed the idea of building a flume, but deemed it too expensive and time consuming, we will contact Dr. Liou about using a larger flume in his lab.
5. Team will send finalized scope of work to Dr. Xing by Friday afternoon
6. Team will sent current portfolio to Dr. Xing by finals week

12/13/13 Finalize Scope of Work (30 minutes)

1. Team finalized scope of work and budget to send to Clear Springs, see file in Drop Box, this is also attached to final portfolio for fall semester.

1/23/13 Team Meeting (45 Minutes)

1. Matt Email Dr. Beyerline about change of meeting location, room 112 in GJ
2. We will keep small scale test with Dr. Liou small flume
3. Moving forward with cart design, using channel lock design to keep baffle in place, could also be designed to implement the suction design.
4. Need to select a plastic for baffle that will not deform.
5. Replacing Horizontal baffle attachment with water jet on Vertical baffle.
6. CFD Testing to be done
  - a. Horizontal baffle / moving components
  - b. Water jet baffle
  - c. Baffle below free surface.
  - d. Multiple baffle system
7. Continue with suction method design.

8. Simulation Matrix by next meeting, to define parameters for experimental studies.
9. Agenda by next meeting, itemized on issues and how we plan to move forward.
10. Design review Feb, 13 at 11 am. Plan on skype, use phone interview if possible.

#### 2/6/13 Team Meeting (33 minutes)

1. Matt: check with BAE conference room is open for Design Review, talk with Judy about conference call
2. Design review: one week from today.
3. Presentation by next Tuesday, summary CFD results, solid works images with layouts and explanation of different components, explain how we will progress with accurate small scale testing.
4. Work with smaller flume with measuring flow, just need to measure velocity and work with similitude for modeling data.
5. Estimate Reynolds and Froude number for real raceway and match that to small scale, put this in design review. (Matt and Levi and Kate)
6. Make L tube for measuring velocity use sq. root  $2gh$  to find velocity and then cross sectional area for flow in the flume, assuming steady state.
7. Use share screen on Skype to present project.
8. Once we have a model to build, talk to Jeremy and Molly about pricing of materials.

#### 2/20/2014 Team Meeting (30 Mintues)

1. Type up EXPO project form for Xing and email to him by next week.
2. Bringing flume to EXPO, speak with Dr. Liou about it.
3. Mini Grant Application, fill out and email to Xing, due date is March 7, send to Dr. Xing by next meeting.
4. Start working on the small-scale flume design. How are we going to move it and show it off at the EXPO? Refine the ideas that we currently have. 3 or so different heights of horizontal baffle.
5. Horizontal baffle testing in small scale flume
6. Build small-scale cart for holding the baffle.
7. Matt, Kate and Levi: sensor for project, Oxygen Level or velocity timing or flow monitoring.
8. Matt: ask Coats about DO probes.

#### 2/27/2014 Team Meeting (30 min)

1. Speak with Dr. Liou about setting up flume form EXPO, power requirements etc...
2. Mini grant brief summary for Dr. Xing by next Tuesday.
3. Small scale testing still needs to be planned out and completed,
4. Speak with mentor Jeremy on ideas for building small scale baffles.
5. Meet with Jeremy 11 next Tuesday for CFD simulation.
6. Formulate a plan with Jeremy on construction
7. Need to research where DO probe will go.

#### 3/2/14 Team Solid Works and summary writing

1. Team meet up to design small scale design for testing in flume
2. Team also met with Jeremy to discuss materials for construction, we will use aluminum for base and need to design wheels.

#### 3/6/14 Team Meeting (35 minutes)

1. Cart in raceway causing turbulence, geometry of support may need to be altered.
2. See what configuration of the cart in the raceway will assist in removing manure during testing, also test geometry in CFD.
3. 4 points for moving the baffle up and down.
4. Discuss and devise a method for possibility of connecting additional baffles for small-scale prototype.
5. Get snapshot day presentation completed by Monday
6. CFD simulation for particles in raceway
7. 3D model of prototype for display
8. Begin construction of small-scale prototype with Jeremy in shop.

#### 3/13/14 Team Meeting (22 minutes)

1. Levi has Lego wheels and will bring them
2. Will have all drawings sent to Jeremy for building small-scale prototype.
3. Implement spring idea for flexibility in variation of raceway geometry.
4. Report; talk with equation and results and scientific analysis.
5. Make an appointment with Jeremy for a time slot to discuss design small-scale prototype.
6. Send 441 DO probe project outline to Xing once finished.

#### 3/27/14 Team Meeting 15 minutes

1. Drawings for small scale are complete, building of prototype will be done on Monday
2. Work on developing a way to attach horizontal baffle.
3. Start testing as soon as possible.

#### 4/3/14 Team Meeting (15 minutes)

1. finish testing and start paper

#### 4/17/14 Team Meeting

1. Need a horizontal baffle test with different gap size
2. Manually move for now, optimize the lower re-suspension.
3. Final conference call with CS
4. Design poster
5. Different gap size, and move manure downstream so that baffle doesn't re-suspend immediately.